CIVIL ENGINEERING DIVISION
U.S. COAST GUARD
WASHINGTON, D.C.

MAY l987

SPECIFICATION NO. G-ECV-191C

PRIMARY BATTERIES AND BUOY POWER UNITS FOR MARINE AIDS TO NAVIGATION

1. SCOPE

1.1 General. This specification defines requirements for performance, design and fabrication, qualification and final inspection, documentation, and packaging for air-depolarized primary batteries and buoy power units. This equipment will provide power to operate 12-volt (nominal 12.5-volt) direct current (DC) navigational signal lights and electronic sound signals on fixed structures and buoys. Primary batteries and buoy power units will be housed in vented battery boxes and vented pockets of buoys deployed in navigable waters of the United States, respectively. Signal loads consist of fixed-on incandescent lamps drawing up to 0.77 amperes, flashing incandescent lamps drawing up to 3.05 amperes, and intermittent sound signals drawing up to 3.60 amperes.

1.2 Equipment. This specification establishes requirements for equipment in six standard ratings:

a. 1000 Ampere-Hour Primary Batteries (*).
b. 2000 Ampere-Hour Primary Batteries (*).
c. 3000 Ampere-Hour Primary Batteries (*).
d. 1000 Ampere-Hour Buoy Power Units (nominal 12.5 volts).
e. 2000 Ampere-Hour Buoy Power Units (nominal 12.5 volts).
f. 3000 Ampere-Hour Buoy Power Units (nominal 12.5 volts).

In all six standard ratings, equipment of the following types is required:

a. Liquid electrolyte - activated by manufacturer.
b. Liquid electrolyte - shipped dry, activated by user by addition of potable water.
c. Gelatinous, dry, or paste electrolyte - activated by manufacturer.

* Primary battery voltages shall be such that batteries can be wired in series to supply nominal 12.5-volt DC power.

1.3 Classification. Equipment described by this specification is classified according to application, capacity, activation procedure, and electrolyte. Primary batteries used on fixed structures are classified further by a prefix indicating number of cells per primary battery. Classification codes follow:

1	1-cell (nominal 1.25 volts/cell)
2	2-cell (nominal 1.25 volts/cell)
3	3-cell (nominal 1.25 volts/cell)
B	Buoy power unit (nominal 12.5 volts)
S	Primary battery for fixed structure
10	1000 ampere-hour capacity
20	2000 ampere-hour capacity
30	3000 ampere-hour capacity
R	Reservoir top (liquid electrolyte buoy power units only)
D	Dry, paste, or gelatinous electolyte; activated by manufacturer

A Liquid electrolyte, activated by manufacturer
F Liquid electrolyte, activated with potable water/electrolyte by user

Examples of equipment classification follow:

a. B10A - Buoy power unit, nominal 12.5 volts, 1000 ampere-hours, liquid electrolyte, activated by manufacturer.
b. 3S30D - 3-cell, fixed structure primary battery, nominal 1.25 volts (three 1.25-volt cells in parallel), 3000 ampere-hours, dry/paste/gelatinous electrolyte, activated by manufacturer.
c. B30RA - Buoy power unit, nominal 12.5 volts, 3000 ampere-hours, liquid electrolyte, reservoir tops, activated by manufacturer.
d. B10 - Buoy power unit, nominal 12.5 volts, 1000 ampere-hours, activation procedure and electrolyte unspecified.

1.4 Documentation. This specification establishes requirements for the following documentation:

a. Qualification Test Plan.
b. Qualification Test Data and Final Report.
c. Chemical Analysis Certificate.
d. Design Standardization Certificate.

1.5 Precedence. Any ambiguity or conflict between this specification, drawings, or applicable documents shall be resolved by utilizing documents in the precedence shown:

a. This specification.
b. Drawings.
c. Applicable documents.

1.6 Notes. The following definitions apply to this specification:

1.6.1 Buoy Power Unit. An assembly of primary batteries wired to provide a nominal 12.5-volt output at the ampere-hour capacity required, packaged into a disposable container serving as a battery rack. The buoy power unit provides 12-volt DC power to a floating aid to navigation when located within a vented 22" or 24" diameter buoy pocket as shown on CG Drawing EOE 107400.

1.6.2 Cutoff Voltage. The minimum acceptable load voltage.

1.6.3 Load Voltage. The voltage measured across the terminals while delivering power to a load.

1.6.4 Open Circuit Voltage. The voltage measured across the positive and negative terminals when no current flows into or out of these terminals.

1.6.5 Power Assembly. A buoy power unit with the PAC (see section 1.6.6) attached in position to be used in a floating aid to navigation.

1.6.6 Power Assembly Clamp (PAC). A non-disposable holding device designed to secure buoy power units in buoy battery pockets. The PAC weighs approximately 50 pounds and is government-furnished.

1.6.7 Primary Battery. The packaged, non-rechargeable, and self-contained source of DC energy consisting of one or more cells; cells may be connected in series or parallel configurations.1.6.8 Service Life. The period over which the equipment is designed to meet its performance requirement in the specified environments.

1.6.9 Shelf Life. The period of time over which the equipment may remain in storage in the specified environment and still deliver 90% of the standard rating. The shelf life period commences on date of manufacture.

1.6.10 Standard Rating. The ampere-hour capacity established under standard conditions. This rating is defined as the ampere-hours delivered into a fixed resistance load sized to discharge the cell at a rate of C/3000 at 68 ± 2^{0}F to a cutoff voltage of 1.02 volts per series cell. C is the rated ampere-hour capacity.

2. APPLICABLE DOCUMENTS

2.1 Applicability. The following documents form a part of this specification to the extent specified herein:

2.1.1 Federal Specification.

a.	Q-Q-S-571	Solder, Tin Alloy, Lead-Tin Alloy and Lead Alloy

2.1.2 Military Specification.

a.	MIL-W-76	Wire and Cable, Hook-up, Electrical, Insulated

2.1.3 Military Standards.

a.	MIL-STD-129H Notice 4, 30 Sep 82	Markings for Shipment and Storage
b.	MIL-STD-810D 19 Jul 83	Environmental Test Methods and Engineering Guidelines

2.1.4 Military Handbook.

a.	MIL-HDBK-53-1A	Military Handbook Guide for Attribute Lot Sampling Inspection and MIL-STD-105

2.1.5 U.S. Coast Guard Drawings.

a.	EOE 107400 Rev I	Power Unit Scope of Supply and Interface Drawing
b.	EOE 120075	Battery Box for Aids to Navigation

2.1.6 Reference Documents.

a. Hazardous Waste Directory
b. Federal Acquisition Regulations (FAR)

2.2 Sources of Documents.

2.2.1 Drawings for Qualification Purposes. The drawings are available from:

a. Specification Preparing Activity (SPA)
Commandant (G-ECV-3A)
U.S. Coast Guard
2100 Second Street SW
Washington, D.C. 20593-0001

2.2.2 Hazardous Waste Directory. This directory is available from:

a. J.J. Keller And Associates
154 West Wisconson Ave.
Neenah, WS. 54956

3. REQUIREMENTS

3.1 Qualification. Primary batteries and buoy power units submitted for qualification and listing on the applicable Qualified Products List (QPL) shall conform to all requirements of this specification. Lithium batteries will not be considered for inclusion on the QPL.

3.2 Design Standardization Certificate. Primary batteries and buoy power units furnished under this specification shall not differ in any way from those previously qualified and approved for listing on the applicable Qualified Products List, except for changes approved in writing by the Specification Preparing Activity (SPA). The manufacturer shall submit a written Design Standardization Certificate to this effect covering each lot of primary batteries and buoy power units furnished under this specification. In the event the manufacturer wishes to introduce any changes to correct design deficiencies, selection of marginal parts, etc., the SPA may require repetition of any or all qualification tests prior to approval of proposed changes.

3.3 Chemical Analysis Certificate. The manufacturer shall submit with qualification documents a Chemical Analysis Certificate from a Government-approved laboratory indicating the percentages by weight of all materials used in cells. Also, electrolyte PH level shall be stated on the certificate.

3.4 Service Life/Shelf Life. Each primary battery and buoy power unit furnished under this specification shall have a service life of at least three years and a shelf life of at least one year. Primary batteries and buoy power units shall be maintenance-free and shall not leak for the duration of service life, once properly installed on aids to navigation. All fasteners and terminal connectors shall be corrosion-resistant and lifting devices shall be impervious to battery chemicals, for the duration of the service life.

3.5 Environmental Conditions.

3.5.1 Storage Environment. Primary batteries and buoy power units shall withstand the below-defined storage environment, without damage or deformation, for the shelf life duration of one year:

Ambient Air Temperature	25^0F to 95^0F

Humidity	0 to 100 percent relative
Non-Level Storage	10^0 tilt from normal upright storage

3.5.2 Service Life Environment. Primary batteries and buoy power units, after satisfying the requirement in Section 3.5.1, shall operate in accordance with this specification for at least three years in the below-defined service life environment:

Ambient Air Temperature	-25^0F to 125^0F
Humidity	0 to 100 percent relative
Atmosphere	Continuous exposure to salt air
Shock and Vibration	Shock/vibration incident to transportation and buoy service
Non-Level Operation	30^0 tilt from normal upright operation

3.5.3 Buoy Battery Pocket Air Test Environment. Buoy power units shall withstand air pressurization testing of buoy battery pockets with no adverse effects. These field tests are normally conducted with the buoy in an inclined position.

3.6 System Voltage. Primary batteries shall be configured for assembly into nominal 12.5-volt systems. Buoy power units shall be delivered prewired into nominal 12.5-volt systems.

3.6.1 Maximum Voltage. Maximum open circuit voltage of a nominal 12.5-volt system shall be 18.0 volts.

3.6.2 Cutoff Voltage. Cutoff voltage of a nominal 12.5-volt system shall be 10.2 volts.

3.6.3 Surge Current. Each primary battery and buoy power unit shall provide a minimum surge current of 3.2 amperes per 1000 ampere-hours of capacity, of 20 milliseconds duration, over service life of the battery assembly.

3.7 Primary Battery Mechanical Requirements.

3.7.1 Physical Dimensions and Weight. Primary batteries shall be sized and constructed so that when assembled into nominal 12.5-volt systems, the systems do not exceed below-tabulated maximum allowable dimensions and weights:

Class	Max Height	Max Total Activated Weight	Dimensions
S10	12"	200 lbs *	Must fit inside one USCG 26"x18"x17.5" battery box.
S20	12"	400 lbs *	Must fit inside two USCG 26"x18"x17.5" battery boxes.
S30	12"	600 lbs *	Must fit inside two USCG 26"x18"x17.5" battery boxes.

* Primary batteries making up systems shall not have individual weights

exceeding 50 lbs (activated).

3.7.2 Lifting Device Capacity. Each primary battery shall have a lifting device with a load capacity of 3 times the weight of the attached unit. The plastic shipping bags, if equipped with handles, may serve as lifting devices.

3.7.3 Terminals. Positive battery terminals shall be marked permanently with positive (+) symbols and color-coded black; negative terminals shall be marked permanently with minus (-) symbols and color-coded white. All nuts and studs shall accept 70 $\pm$ 10 inch-pounds torque; all manufacturer-made connections shall be torqued to 40 $\pm$ 5 inch-pounds. Terminal posts shall be at least 1/4 inch in diameter with 20 threads per inch and shall be designed to accept 3/8 inch wide (inner dimension) spade lugs. Terminal posts shall be protected against short circuits during shipment. Both terminal posts shall be equipped with two flat washers, one lock washer, and one nut (elastic stopnut or wingnut) each. A short length of wire or bus bar suitable for connecting batteries shall be securely attached to each negative terminal; if wire is used, it shall have ring lugs on each end sized to fit the battery terminal posts.

3.7.4 Venting and Filling Apertures. Primary batteries with liquid electrolyte shall be provided with molded or other type non-splash vents. The vent may serve as the filling aperture; however, if the molded type vent is used, a separate filling aperture shall be provided. The non-splash vent shall be made of an electrolyte-resistant compound, and shall be provided with baffles or an equally effective means of splash prevention.

3.8 Buoy Power Unit Mechanical Requirements.

3.8.1 Physical Dimensions And Weight. Buoy power units shall be constructed to fit in the physical space defined by drawing EOE 107400 Rev I. The 1000, 2000, and 3000 ampere-hour power units shall not weigh more than 225, 450, and 650 pounds, respectively, when filled with electrolyte and activated.

3.8.2 Structural Adequacy. Buoy power units shall protect primary batteries from damage during handling, installation, and operation in cylindrical buoy battery pockets; buoy power units shall have sufficient structural strength to hold and support the weight of the batteries and the Power Assembly Clamp (PAC). Power unit torsional rigidity shall be such that when standing upright on a firm surface, without the PAC installed, the top of the power unit will not rotate more than 4^0 when a torque of 100 foot-pounds is applied. Torque shall be applied in such a manner that pure rotation is applied to the top of the buoy power unit.

3.8.3 Finish. All buoy power unit exposed surfaces shall be smooth and free of splinters or other sharp protrusions which could be injurious to servicing field personnel. If necessary, surfaces shall be painted to prevent formation of splinters.

3.8.4 Rigging. Each buoy power unit shall have a lifting eye (see Section 3.8.8) and rope or cable strap(s) as shown on drawing EOE 107400 Rev I; both the lifting eye and rope/cable strap(s) shall be capable of supporting three times the weight of the attached buoy power unit. The lifting eye shall be

located so that the power assembly can be lifted vertically. The strap(s) shall clear the power assembly lifting eye by at least 12 inches and shall be located so that the power unit is suspended at 45 $\pm$ 5^0 from the vertical when lifted; the strap(s) shall be impervious to battery chemicals.

3.8.5 Terminal Block. A terminal block shall be centered under one of the 5-inch diameter holes in the Power Assembly Clamp (PAC) as indicated in drawing EOE 107400 Rev I. The terminal block shall accept 3/8-inch wide (inner dimension) spade lugs. The terminal block shall be of the insulated barrier type with 10-32 screw terminals and shall not extend more than 2 inches above the top of the buoy power unit. Screw terminals shall position spade lugs at least 1/2 inch above the top of the buoy power unit (see drawing EOE 107400).

3.8.6 Locking Device. A locking device shall be incorporated into the buoy power unit which prevents rotation of the power unit with respect to the Power Assembly Clamp (see drawing EOE 107400). The locking device shall be either hardwood or metal and shall extend at least 1/2" but not more than 1-1/4" above the uppermost portion of the power unit. It shall be designed to engage the Power Assembly Clamp in the two holes which do not provide access to the terminal block.

3.8.7 Universal Spacer. A universal spacer shall be provided which adapts the base of the power unit to either 22-inch or 24-inch diameter battery pockets. Universal spacers shall allow field conversion of power units to fit 22-inch and 24-inch diameter pockets and shall restrict power assembly movement to 3/8 inch in any transverse direction. Field conversion shall be accomplished by a simple procedure such as reversing the universal spacer. All buoy power units shall be supplied with the universal spacer set for a 22-inch diameter battery pocket (see drawing EOE 107400).

3.8.8 Eye Nut. A 5/8-inch National Course (N.C.) stud shall protrude through the top of the buoy power unit and shall accept a standard 5/8-inch eye nut. The eye nut, as one of the power assembly lifting devices, shall be capable of supporting 3 times the weight of the power assembly. The inside diameter of the eye shall be 1.25 $\pm$ 0.125 inches. The stud shall protrude above the PAC far enough to allow full engagement of the eye nut threads. The stud shall be designed so that the eye nut can be removed from the stud without shifting of the stud (see drawing EOE 107400).

3.8.9 Reservoir Tops. Primary batteries with liquid electrolyte which are components of buoy power units shall be provided with non-spill vent valves or reservoir tops. The vent valve socket may serve as the filling aperture; however, a separate filling aperture shall be provided if the molded type vent valve is used. Manufacturer-activated and dry buoy power units do not require filling apertures. Filler plugs shall be provided when molded vent valves are used.

3.9 Wiring. All wiring subject to flexing service shall be insulated stranded copper wire. Bus bars and wiring shall be sized to allow continuous short circuit current without damage to wiring or bus bars.

3.10 Solder. Solder used in making electrical connections and in tinning operations shall be composition SN30 (30% tin) or higher. Crimped or

mechanical connections are permissible for internal battery connections.

3.11 Identification Tag. Each primary battery and buoy power unit shall include a permanent identification tag. The identification tag shall provide month and year punch-outs or space to write in the date the equipment was placed into service. It shall also contain the information indicated below, which shall be legible at a distance of 24 inches from the naked eye:

a. Stock number.
b. Nominal voltage rating.
c. Nominal ampere-hour capacity.
d. Month and year of manufacture (e.g. MAR 87 or 03/87).
e. Manufacturer's lot number.

On primary batteries, the tag shall be located on the top surface. On buoy power units, the tag shall be located on the top surface next to the locking device, so that it will be visible through one of the holes in the Power Assembly Clamp (PAC).

4. INSPECTION AND ACCEPTANCE

4.1 Classification. Inspection requirements are classified as follows:

a.	Qualification	Section 4.3
b.	Production	Section 4.4

4.2 Responsibility.

4.2.1 Qualification Inspection. Qualification inspections shall be the responsibility of the manufacturer and shall be conducted at facilities acceptable to the Government. Portions of the qualification inspections may be waived if the manufacturer is able to present acceptable documentation of previous compliance with that portion of this specification.

4.2.2 Production Inspection. The manufacturer shall conform to all requirements of the Federal Acquisition Regulations (FAR) Part 52.246-1: Contractor Inspection Requirements, and Part 52.246-2: Inspection of Supplies, Fixed Price.

4.3 Qualification.

4.3.1 Test Plan. The manufacturer shall submit to the Specification Preparing Activity, for approval in writing, a detailed qualification test plan and documentation supporting requests for waiver of any of the testing. After written approval of the qualification test plan, a Government representative will be assigned to monitor the tests. The test plan shall be submitted to the SPA not later than 30 days prior to commencement of qualification testing. At a minimum this plan shall include:

sequence listed:

and Drawings (Section 4.3.4).

e. Capacity Test (Section 4.3.8).

4.3.3 Sample Submission. Primary batteries and buoy power units submitted for qualification shall be representative of the manufacturer's proposed normal production. Sample size for testing shall consist of one (1) primary battery of each ampere-hour rating (3 total) and one (1) buoy power unit of each ampere-hour rating (3 total), of each type offered (i.e. liquid electrolyte, gel, etc.). (Manufacturers may qualify one or more types.)

4.3.4 Visual Inspection and Mechanical Conformance to Specifications and Drawings. Measure and check the samples for the following:

3.7.3, 3.8.1, 3.8.4, 3.8.5, 3.8.6, 3.8.7, 3.8.8).

4.3.4.1 Acceptance/Rejection Criteria. Failure of any primary battery or buoy power unit to conform to visual and mechanical requirements listed above shall constitute failure of the entire qualification procedure.

4.3.5 Vibration Test.

4.3.5.1 Procedure. Sample size for vibration testing shall consist of one (1) 1000 ampere-hour primary battery and one (1) sample of the largest buoy power unit offered, for each type (liquid electrolyte, gel electrolyte, etc.) offered. An acceptable alternative to the standard testing method described below shall be to ship the batteries and power units from the east coast (New York) to the west coast (California) and back via commercial land carrier.

4.3.5.2 Buoy Power Unit and Individual Primary Battery Mounting. Primary batteries and buoy power units shall be firmly attached directly to the vibration table by rigid fixtures so that all forces are transmitted directly to the bases of these items. There shall be no additional means of support for these items while undergoing the vibration test.

4.3.5.3 Vibration Control Sensor. The vibration table input control sensing

device(s) shall be rigidly attached to the universal spacer on the base of the power unit.

4.3.5.4 Cycling. Each primary battery and buoy power unit shall be subjected to vibration along its vertical axis only, in accordance with the levels indicated in figure 514.3-1 of MIL-STD-810D (attached as figure 4-1). The frequency shall be swept for a total of 180 minutes from 10 to 500 hertz. Correction for expected excitation below 10 hertz is not required.

4.3.5.5 Inspection Method. A physical inspection without disassembly of the samples shall be performed following these tests. Battery assemblies tested separately shall be physically inspected.

4.3.5.6 Rejection Criteria. Structural damage (cracks greater than 2 inches in length, broken pieces, punctures, etc.) or shifting or leakage of batteries making up a buoy power unit shall constitute a failure of the entire qualification procedure.

4.3.6 Handling Test. One buoy power unit of each size offered, including those previously subjected to the vibration test, shall be subjected to the following Free Fall Drop Test and Pendulum Impact Test procedures in sequence:

4.3.6.1 Free Fall Drop Test. Samples shall be raised to a height of 4 $\pm$ 1/4 inches above a level unyielding surface. Each buoy power unit shall be dropped five times--once flat on its bottom and once on each bottom corner. The apparatus used to drop these buoy power units shall ensure instantaneous release so that no rotational or lateral forces are imparted to the test units.

4.3.6.1.1 Inspection Method. A physical inspection without disassembly of the samples shall be conducted following the the free fall test.

4.3.6.1.2 Rejection Criteria. Structural damage to the buoy power units such as cracks greater than 2 inches in length, broken pieces or punctures, or shifting or leakage of batteries within the buoy power units shall constitute a failure of the entire qualification procedure.

4.3.6.2 Pendulum Impact Test. One buoy power unit of each size offered shall be subjected to the pendulum impact test. The buoy power unit shall be suspended from an overhead attachment by its lifting eye with a cable 14 $\pm$ 2 feet in length and permitted to strike a flat rigid unyielding barrier. The barrier surface shall allow full contact with the power unit and shall be perpendicular to the arc of the unit at contact. The power unit, when hanging free, shall be 9 $\pm$ 1 inches above the floor and 2 $\pm$ 1 inches from the barrier impact surface. The buoy power unit shall be pulled away from the impact surface so that its lowest point is 15 $\pm$ 1 inches above the floor. The power unit then shall be released to allow free impact with the barrier. This procedure shall be performed once for each side of the buoy power unit.

4.3.6.2.1 Inspection Method. A physical inspection without disassembly of the buoy power units shall be performed following the pendulum impact test.

4.3.6.2.2 Rejection Criteria. Structural damage to the buoy power units (cracks greater than 2 inches in length, broken pieces, punctures, etc.) or shifting or leakage of cells within the buoy power units shall constitute a failure of the entire qualification procedure.

4.3.7 Air Pressurization Test.

4.3.7.1 Procedure. All buoy power units previously subjected to the shock and vibration test shall be subjected to an air pressure of 5 ± 0.5 PSIG at 68 ± 2 ^{0}F for 10 ± 1 minutes, after which time the pressure shall be released instantaneously and allowed to return to ambient atmospheric pressure.

4.3.7.2 Inspection Method/Rejection Criteria. After air pressure release, power units shall be physically inspected. Battery case bulges greater than 0.25 inches, battery case cracks, displacement of sealant, or leakage of electrolyte shall constitute failure of the entire qualification procedure.

4.3.8 Capacity Test.

4.3.8.1 Procedure. All primary battery and buoy power unit samples shall be continuously discharged into constant resistance loads until they reach cutoff voltage. Samples shall be maintained at 68 ± 2 ^{0}F throughout the test.

4.3.8.2 Load Resistance and Test Equipment.

4.3.8.2.1 Load Resistors. Load resistors shall be sized to discharge samples at C/3000 rates, where C is the standard capacity of the sample in ampere-hours. Resistance of the load resistor shall not change by more than 2% during the discharge test.

4.3.8.2.2 Voltmeters. Voltmeters shall have internal resistances of at least 1000 ohms per volt and shall be accurate to within 1% of the voltages being read. Digital meters are acceptable.

4.3.8.2.3 Thermometers. Thermometers shall be accurate to within ±2^{0}F.

4.3.8.2.4 Timing Equipment. Timing equipment shall be accurate to within 1.0%.

4.3.8.3 Recording Frequency. Test discharge current, voltage, ambient temperature, and time shall be recorded at hourly intervals when the sample reaches 90% of rated discharge.

4.3.8.4 Capacity Calculation. Capacity shall be calculated as the product of the average discharge current over the entire discharge period and the time required for the battery assembly voltage to fall to a cutoff load voltage of 10.2 volts.

4.3.8.5 Rejection Criteria. More than one primary battery or any buoy power unit failing to meet its standard capacity rating shall constitute a failure of the entire qualification procedure.

4.3.9 Test Data and Final Report. At the conclusion of all qualification testing, the manufacturer shall forward a final report, including all test data, to the Specification Preparing Activity.

4.4 Production. The Contractor shall maintain an inspection system which shall ensure that each item offered to the Coast Guard for acceptance or approval conforms to contract requirements. The inspection system shall be documented and available for review by the Coast Guard. Each inspection lot shall be inspected visually for mechanical conformance to specifications and drawings (Section 4.3.4). The inspection is not intended to supplant any controls, examinations, inspections, or tests normally employed by the Contractor to assure the quality of this product.

4.4.1 Inspection Method. The Contractor's standard inspection methods including lot size, sample size, and rejection criteria may be used to perform the production inspection. The Contractor shall maintain records of all inspections and tests. The records shall indicate the nature and number of observations made, inspectors' initials, the number and type of deficiencies found, and the corrective action taken. Copies of all test reports shall be made available to a Coast Guard inspector on request.

4.4.2 Calibration System. The Contractor shall maintain a calibration and maintenance system to control the accuracy of measurement and test equipment used in the fulfillment of this specification. The system shall include, as a minimum, prescribed calibration intervals, source of calibration, and a monitoring system. The calibration documentation and monitoring system shall be readily available to the Coast Guard Inspector. Calibration shall be traceable to the National Bureau of Standards.

4.4.3 Failure Responsibility. If a battery lot fails to pass production inspection, the Contractor shall take corrective action on the materials or process, or both, as warranted, and on all items or portions thereof which were similarly manufactured and subject to the same cause(s) for failure.

5. PREPARATION FOR DELIVERY

5.1 Packingg. Each primary battery and buoy power unit shall be packed in two
heavy duty plastic bags impervious to battery electrolyte, reaction by-products, and humidity. Bags containing unactivated batteries or power units shall be sealed closed to prevent moisture intrusion. Primary battery bags with integral handles may be used in lieu of battery lifting devices. Primary battery bags shall be designed to remain on batteries when they are deployed on aids to navigation. Bags shall be capable of closure when spent batteries and power units are removed from aids to navigation. Bags shall be leakproof and shall not interfere with battery lifting devices if the bags are not used as lifting devices. In addition to the requirement for the two plastic bags, primary batteries and buoy power units shall be packed in accordance with Section D of the Solicitation/Contract.

5.2 Packaging. Primary batteries and buoy power units shall be packaged in accordance with Section D of the Solicitation/Contract.

5.3 Marking. Containers shall be marked in accordance with MIL-STD-129H Notice 4.

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May l987

Prepared by:

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_____
T. S. WINSLOW, LT, USCG
USCG
Acoustics and Optics Section
Optics

Reviewed by:

S. E. TRENCHARD, LCDR,

Chief, Acoustics and

Section

Approved by:

_____
_____
D. H. DeBOK, CDR, USCG
Chief, Aids to Navigation
Branch

Date

CIVIL ENGINEERING DIVISION
U.S. COAST GUARD
WASHINGTON D.C.

PRIMARY BATTERIES AND BUOY POWER UNITS FOR
MARINE AIDS TO NAVIGATION

CHANGE 1 TO
SPECIFICATION 191C

1. Add the following paragraph to the specification:

4.3.8.4.1 Capacity Certification. Manufacturers shall complete the following equation, show the values for all variables and enclose the results in the final report:

$$RBDT \leq \frac{(RC - SL - CF)}{(L + SD)}$$ Where:

RBDT = Rated Battery Discharge Time, 1095 days;

RC = the theoretical capacity of the battery, in ampere-hours;

SL = the lost charge, in ampere-hours, over a one year shelf life;

CF = any additional correction factors or safety factors applied to the theoretical capacity (RC), in ampere-hours;

L = load: 0.913 ampere-hours/day* for a nominal 1000 ampere-hour rating, 1.826 ampere-hours/day for a nominal 2000 ampere-hour rating, and 2.740 ampere-hours/day for a nominal 3000 ampere-hour rating;

SD = self internal discharge, in ampere-hours/day.

Failure of a manufacturer to meet the specified RBDT shall constitute failure of the qualification procedure.

* Based on a continuous 15 milliampere load with a 0.425 ampere lamp flashing at the rate of 0.4 seconds on, 3.6 seconds off (10% duty cycle) for 13 hours a day.

2. Add the following sentence to paragraphs 3.5.1 Storage Environment and 3.5.2 Service Life Environment:

"Unless specified, all environmental conditions are to be non-continuous."

3. Paragraph 4.3.7.1 Procedure, fourth line, change "instantaneously" to "gradually".

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FOR MARINE AIDS TO NAVIGATION

CHANGE 1 TO SPECIFICATION NO. G-ECV-191C

Jun l988

Prepared by:

_____
_____
J. T. GRASSON
Major Aids Section
Section

Reviewed by:

H. R. CLEVELAND
Chief, Major Aids

Approved by:

_____
_____
J. D. GARRISON, CDR, USCG
Chief, Ocean Engineering Branch

Date